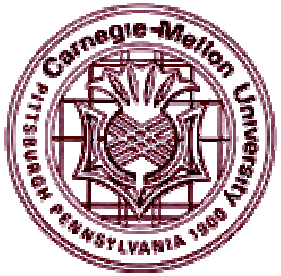


CARNEGIE MELLON UNIVERSITY

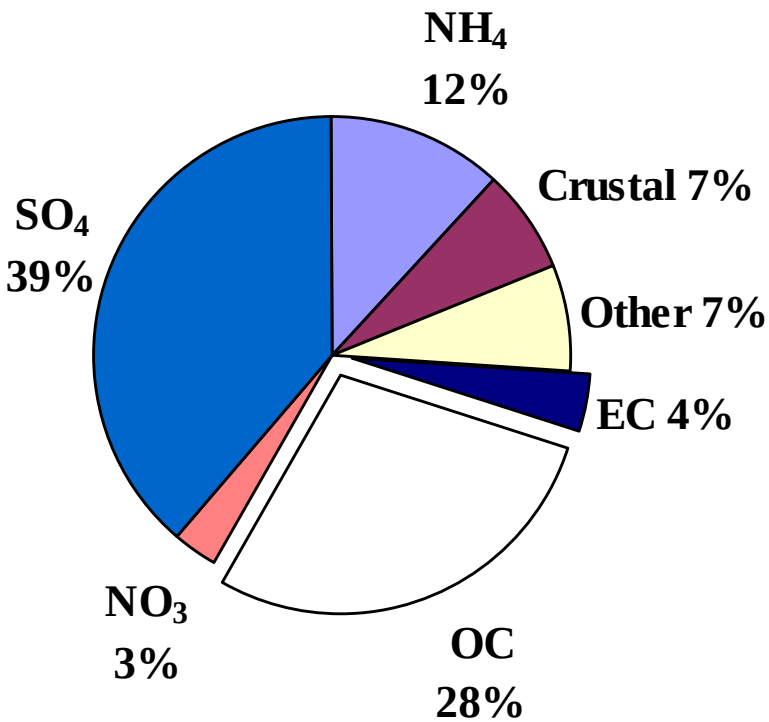
The contribution of long-range transport and secondary organic aerosol to $PM_{2.5}$ in Pittsburgh

Juan C. Cabada-Amaya, Spyros N. Pandis, Allen L. Robinson, Ramachandran Subramanian, Wei Tang, Natalie J. Anderson, Timothy Raymond, Cliff I. Davidson

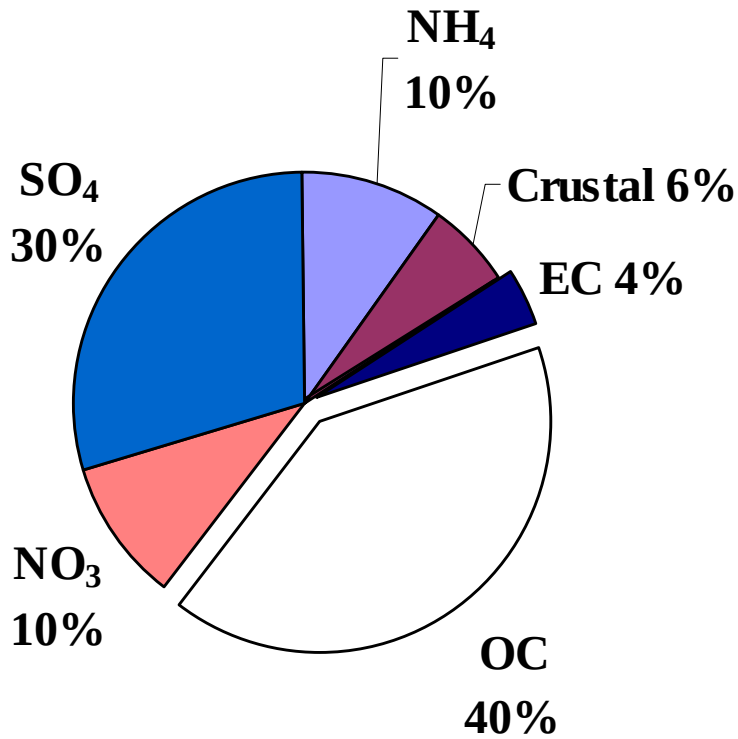
Outline

- Motivation and Definitions.
- Sampling methods of Carbonaceous material at PAQS.
- Carbonaceous material composition for July 2001.
- Carbonaceous material composition from July 2001 to February 2002.

$PM_{2.5}$ composition PAQS.



July 2001, 20 μg/m^3



December 2001, 10 μg/m^3

OC/EC Sources

[EC]

[OC pri] + [OC sec]

Background

ROG + O_3 **OH** NO_3

Secondary Organic Aerosol Production in region

Urban Atmosphere

Biogenic Aerosol

Power Plants

Primary OC and EC Emissions in region

Automobiles

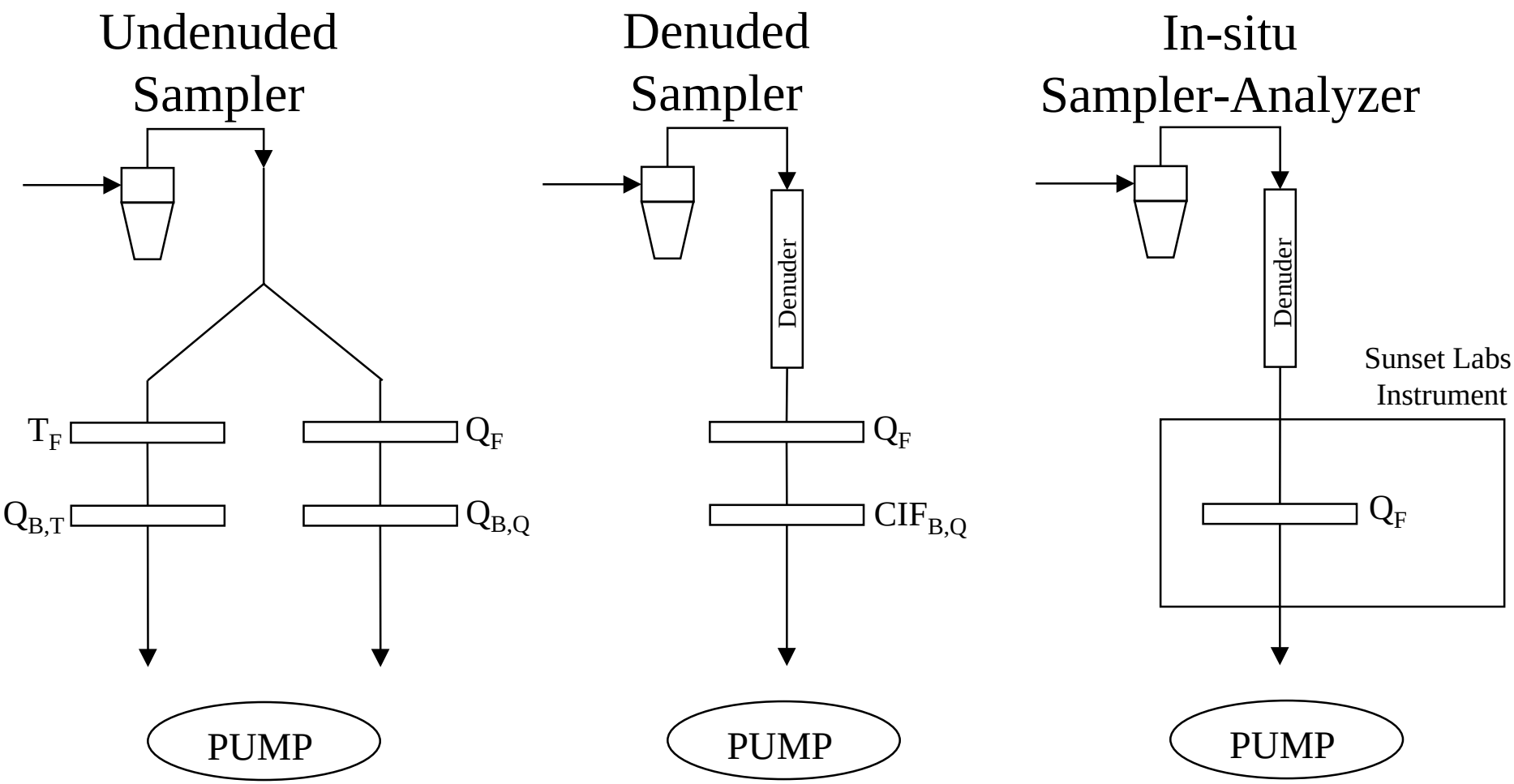
Diesel Trucks

Wood Burning

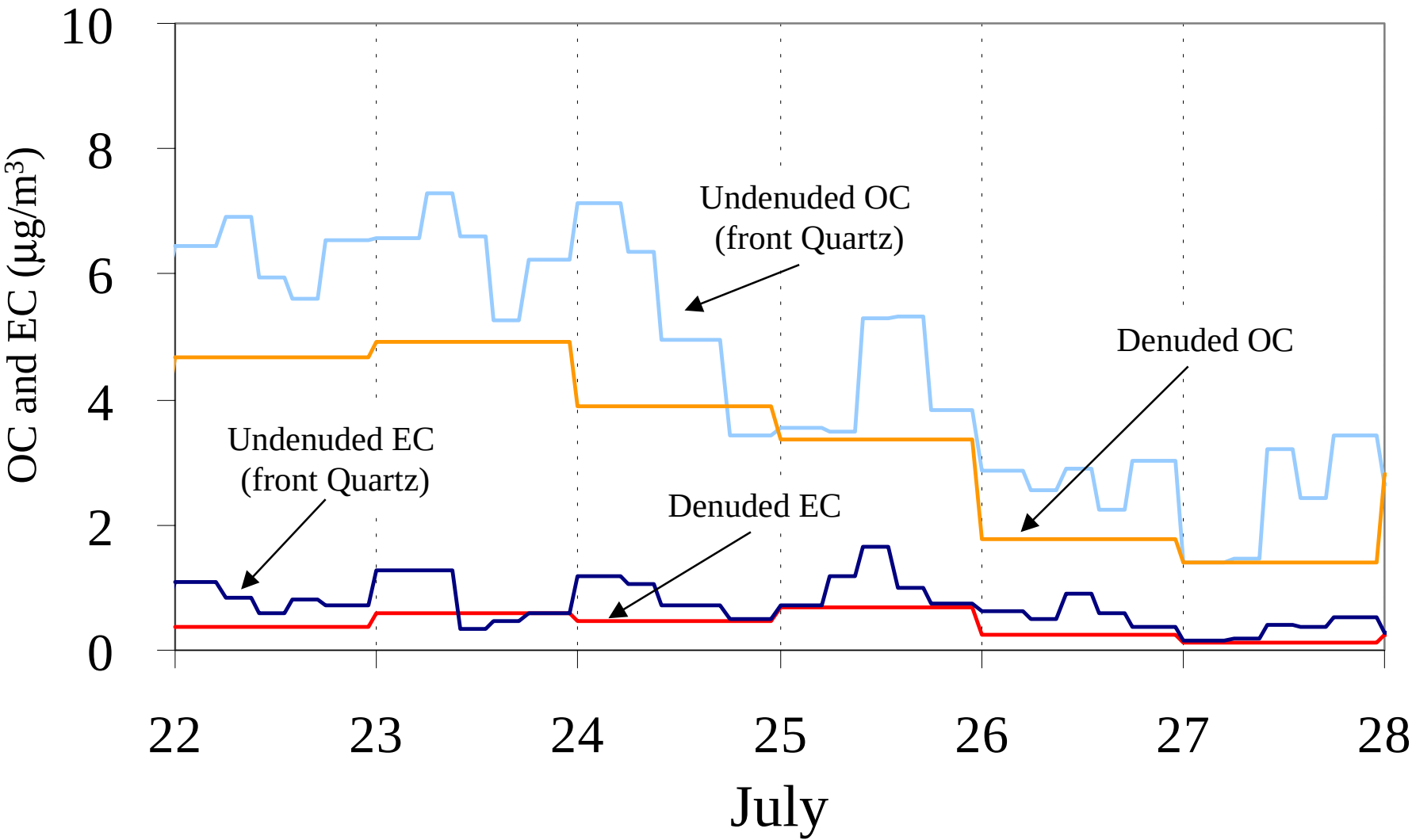
Factories

PAQS Central sampling site

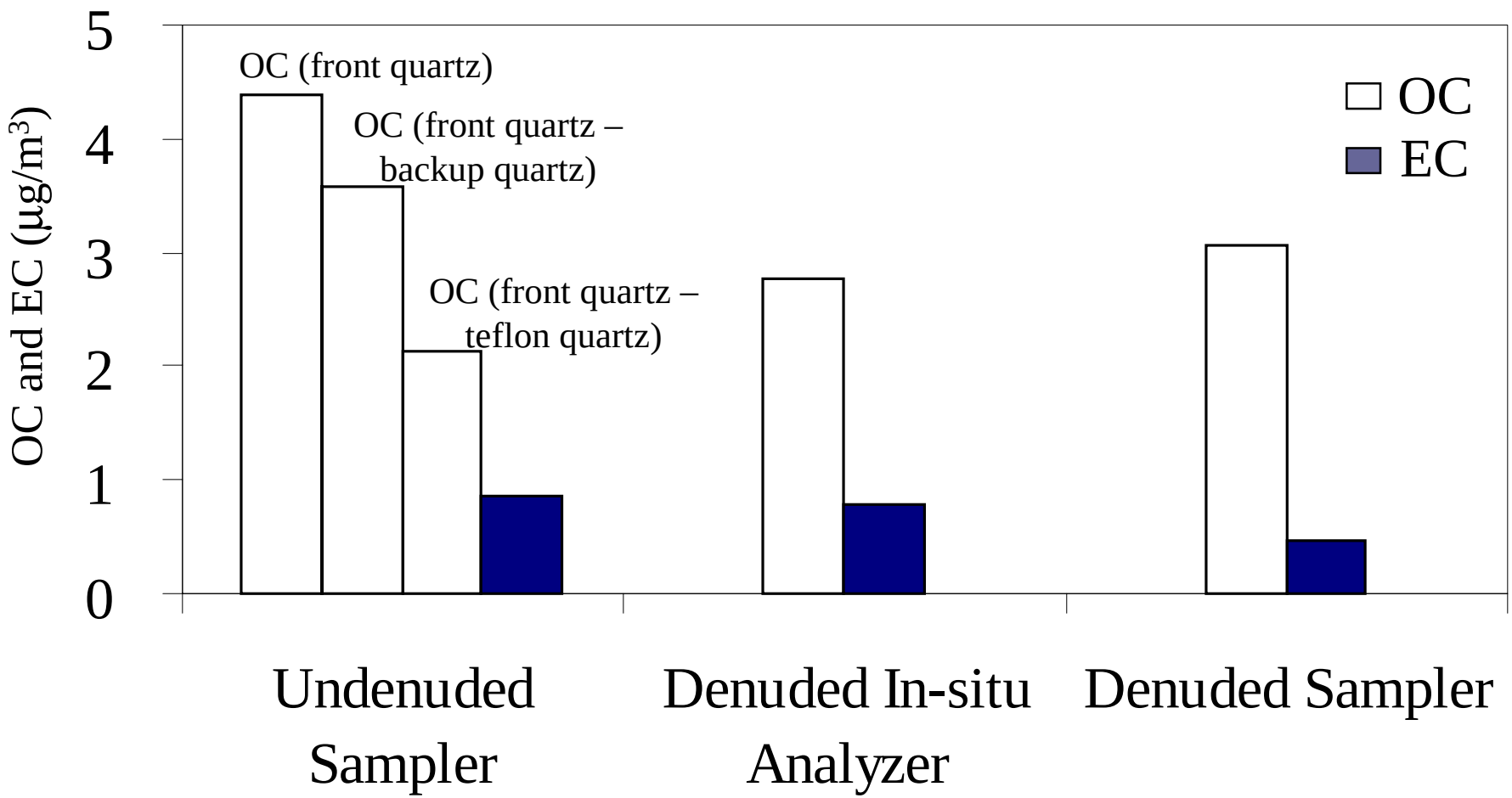
OC and EC Sampler Configurations (PAQS)



OC and EC Measurements (PAQS, July 2001)



Average OC and EC concentrations (PAQS, July 2001)

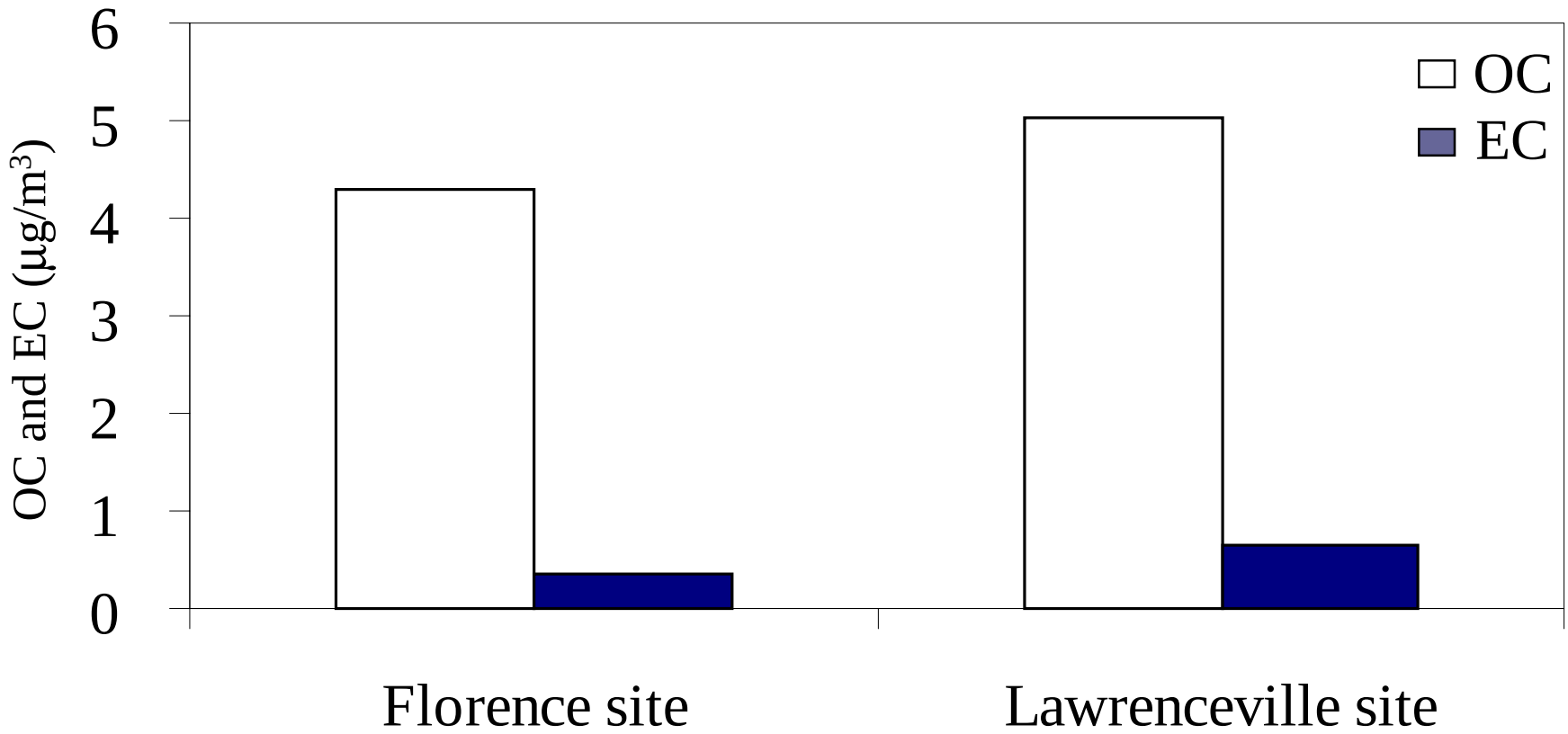


Questions?

- Where is carbonaceous material coming from?
  - Regional or Local?
- What fraction of the measured organic carbon is primary and secondary?

Sampling Sites

Regional Contribution of OC and EC to Pittsburgh



- Around 80% of carbonaceous material in Pittsburgh during July 2001 was due to long transport processes

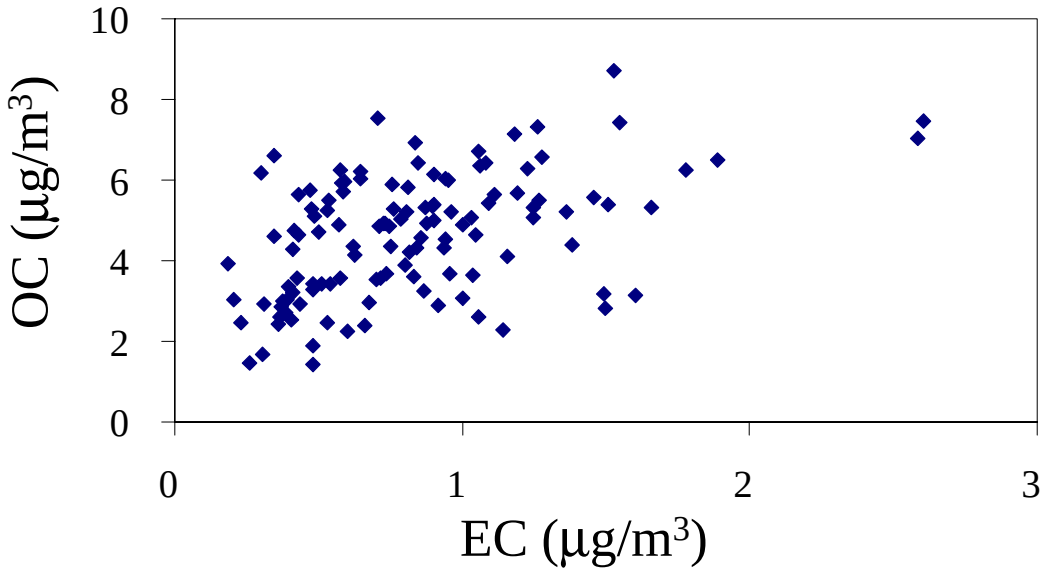
Primary vs. Secondary OC

- EC can be used as tracer for primary OC.

$$OC|_{secondary} = OC|_{total} - EC|_{total} * OC/EC|_{emitted}$$

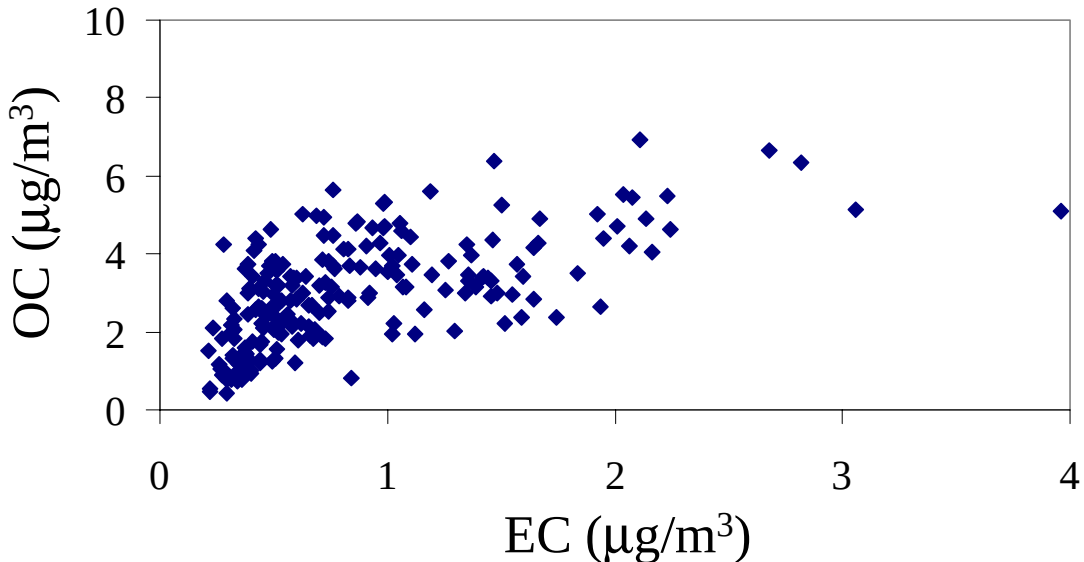
- Ambient Samples ($OC|_{total}$ and $EC|_{total}$)
- Determine ratio of OC/EC primary emissions. ($OC/EC|_{emitted}$)

OC and EC high resolution measurements, July 2001

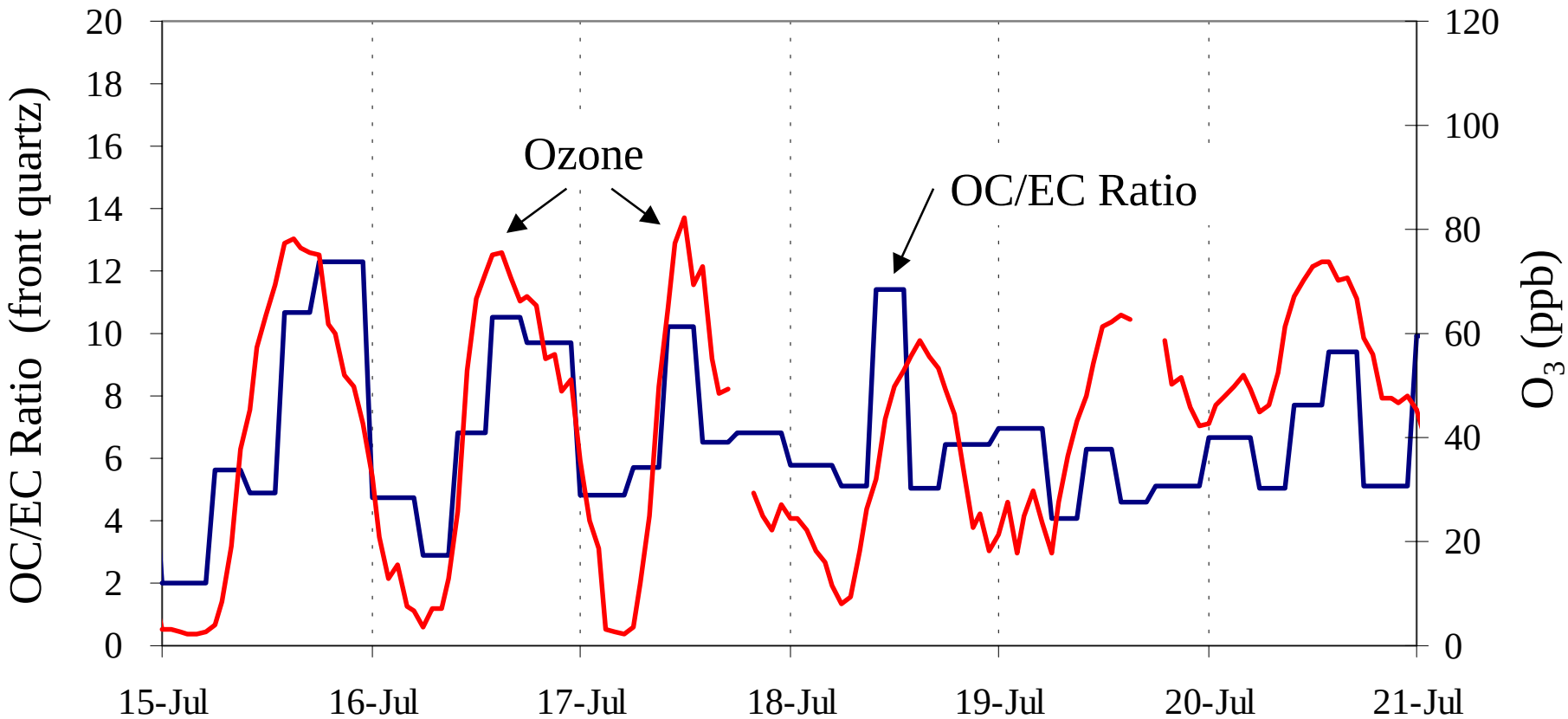


Undenuded Sampler
(4-6 hrs samples)

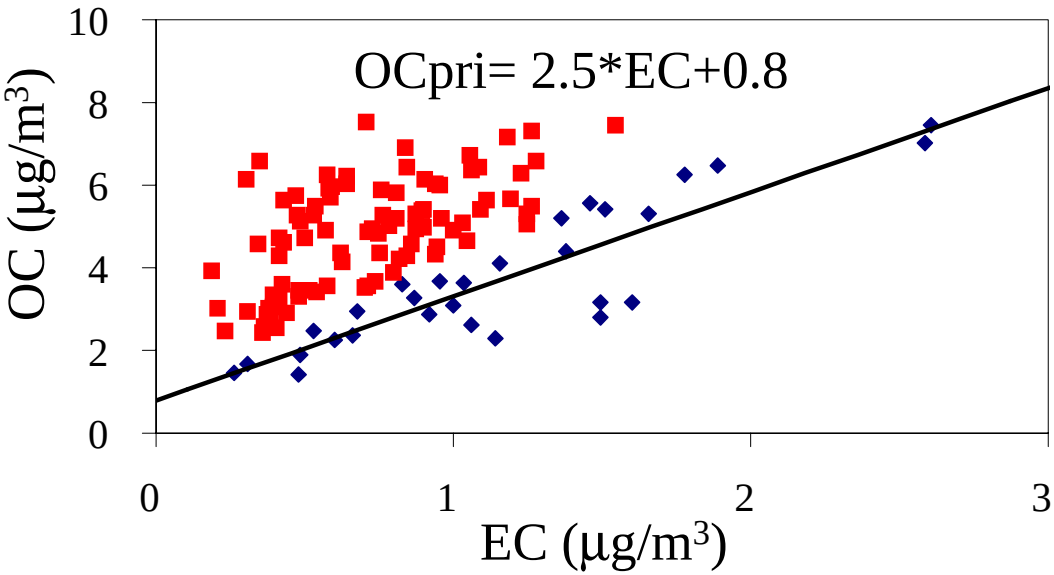
Denuded
In-situ Analyzer
(2-4 hrs samples)



Ozone as indicator of Photochemical activity

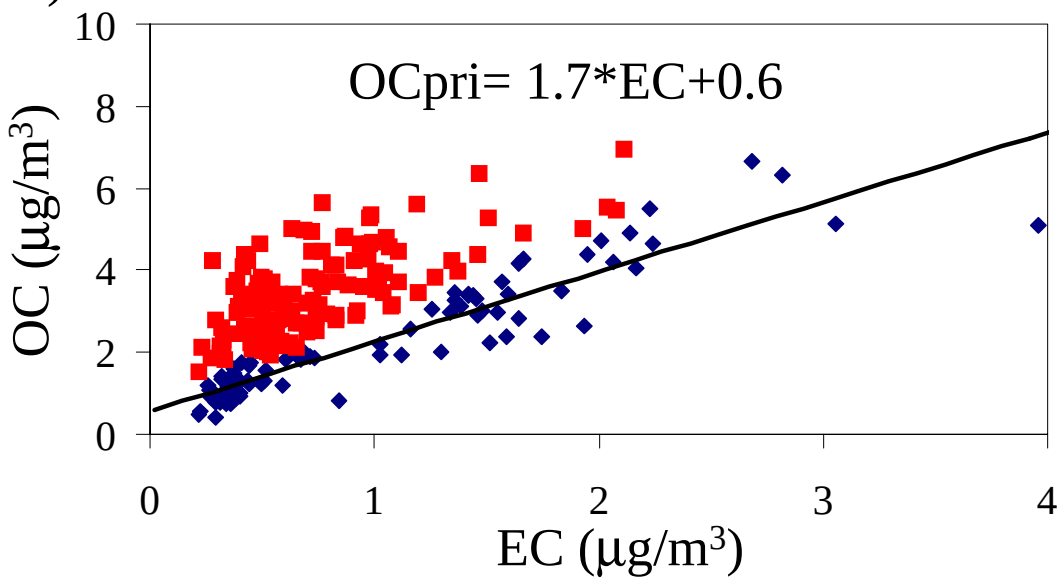


OC/EC Ratio from measurements, July 2001



Undenuded Sampler
(4-6 hrs samples)

Denuded
In-situ Analyzer
(2-4 hrs samples)

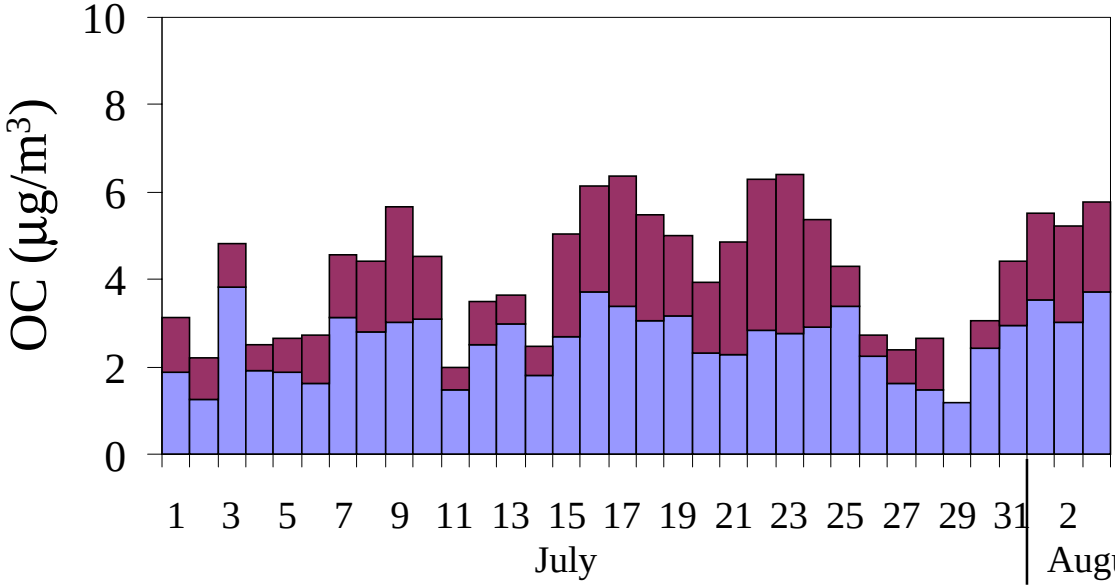


Primary OC/EC Ratios from high resolution measurements, July 2001

Measurement (2-6 hrs)	OC/EC pri	Non-combustion primary OC
Undenuded (front quartz)	2.5	0.8
Undenuded (front quartz –teflon quartz correction)	1.0	0.4
Undenuded (front quartz - backup quartz correction)	2.5	0.1
Denuded In-situ analyzer	1.8	0.4

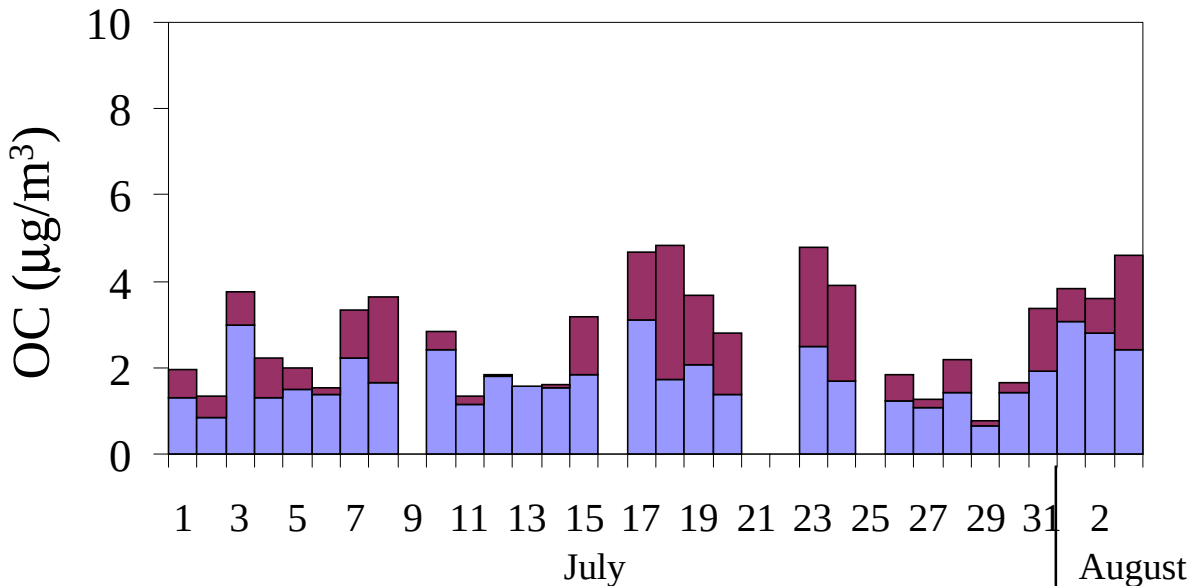
Based on NIOSH method measurements

Daily Averaged OC Composition, July 2001

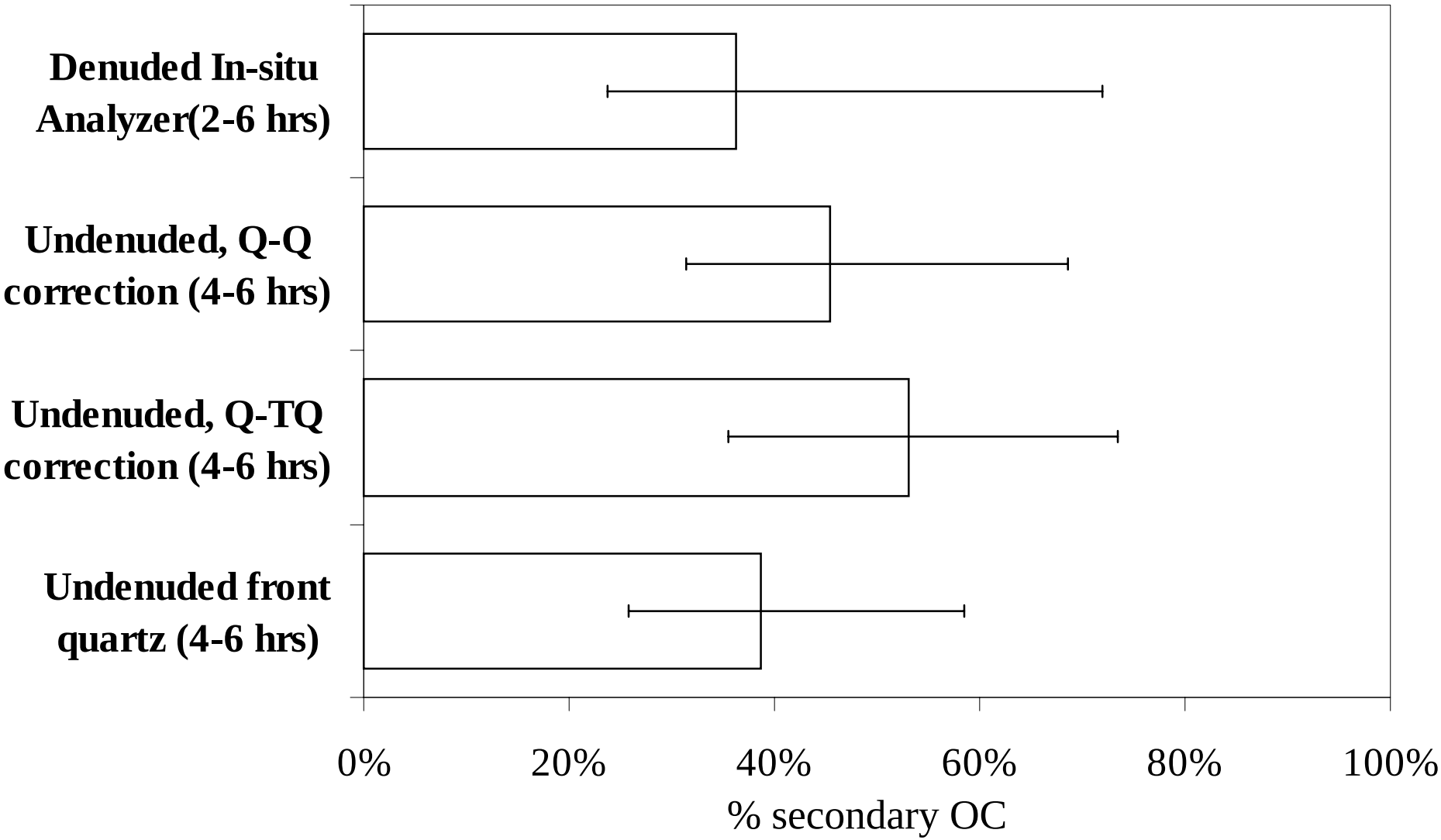


Undenuded Sampler
(4-6 hrs samples)

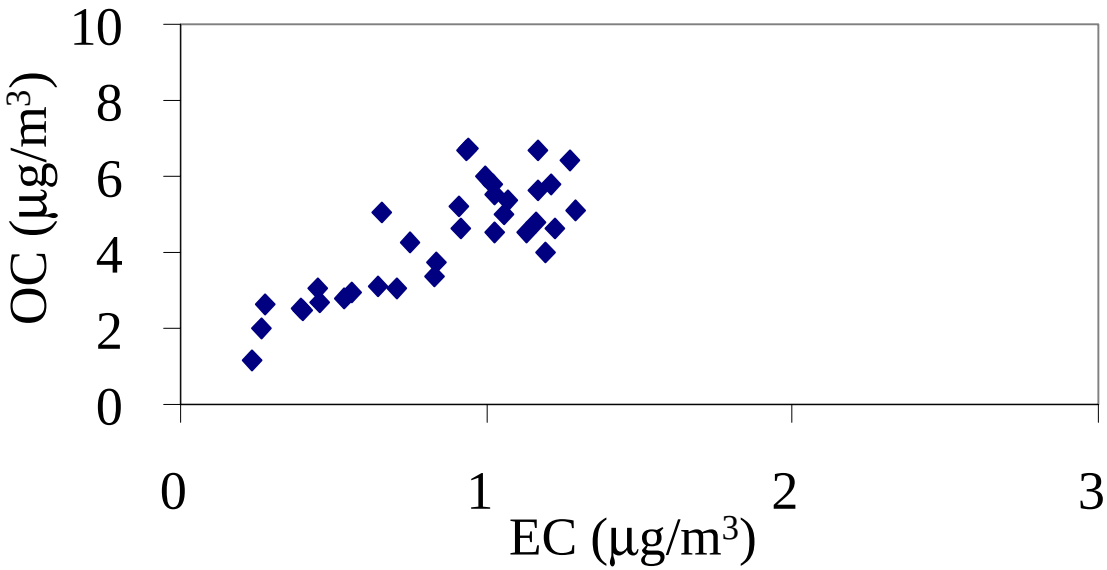
Denuded
In-situ Analyzer
(2-4 hrs samples)



OC Composition, high resolution measurements, July 2001

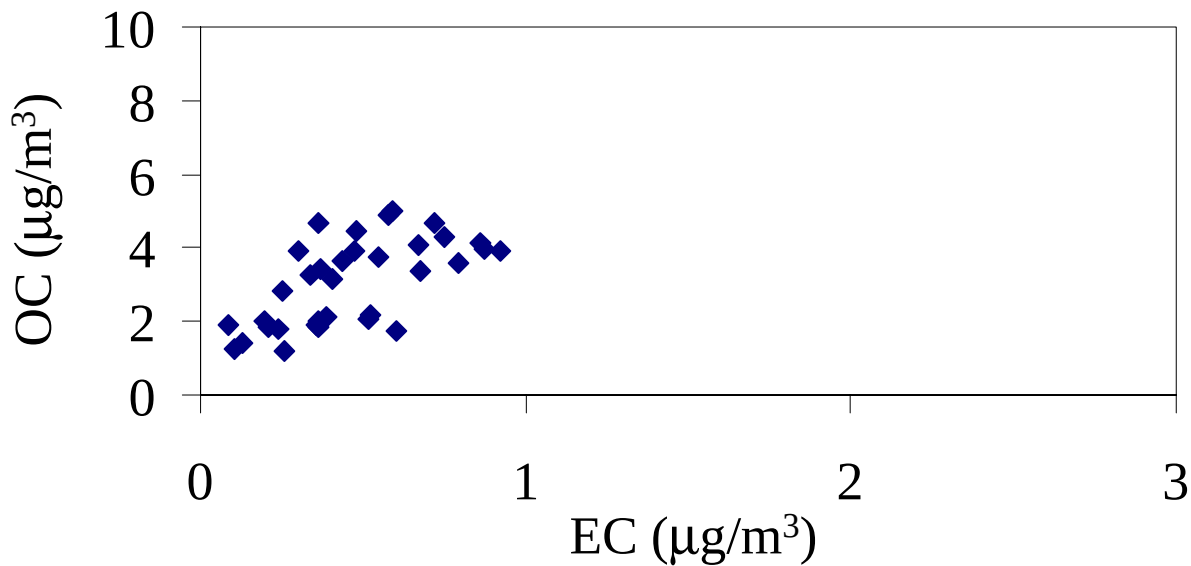


OC and EC Daily measurements, July 2001

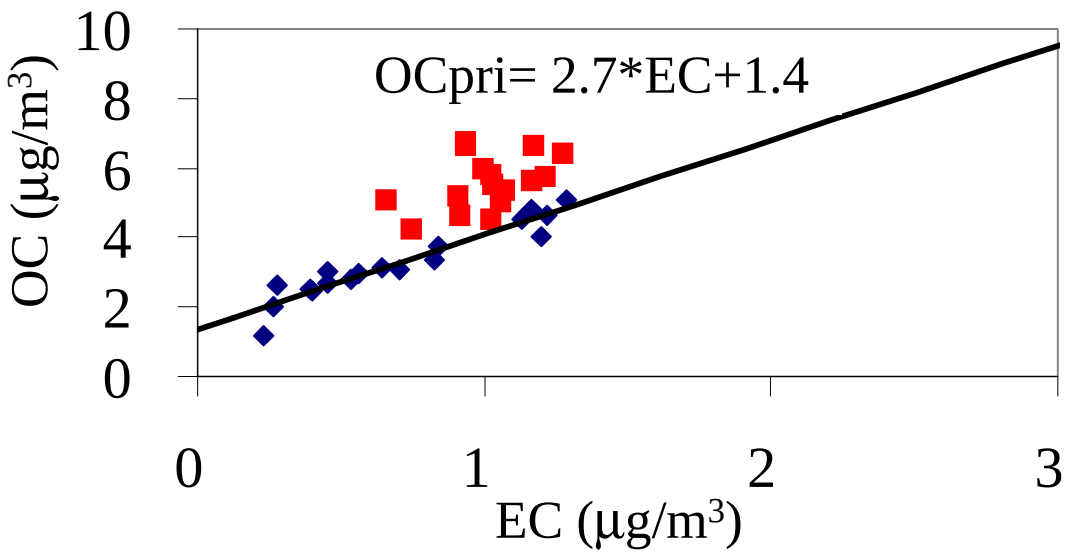


Undenuded Sampler
(24 hrs averages)

Denuded
Sampler
(24 hrs samples)

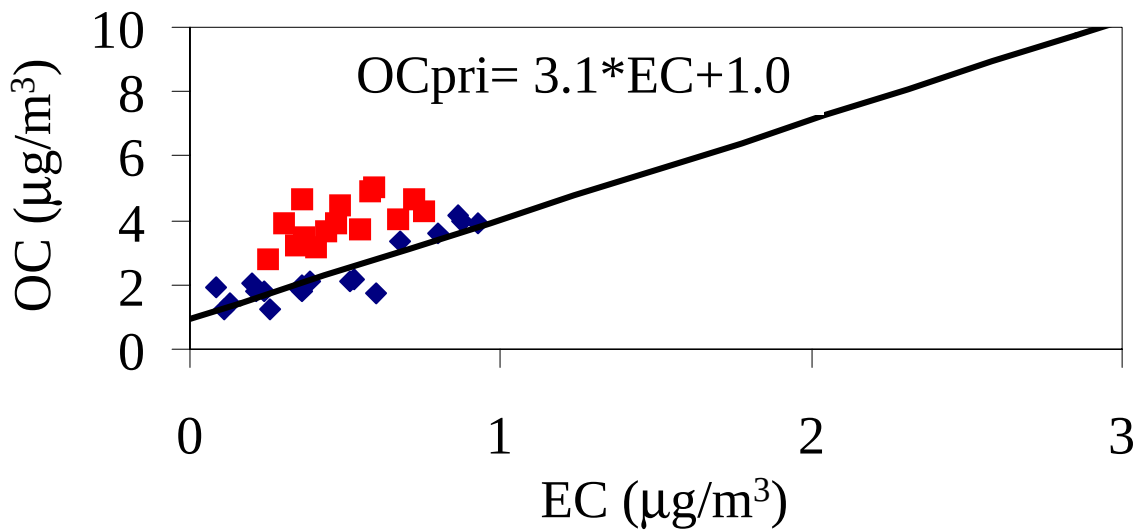


OC/EC Ratio from measurements, July 2001

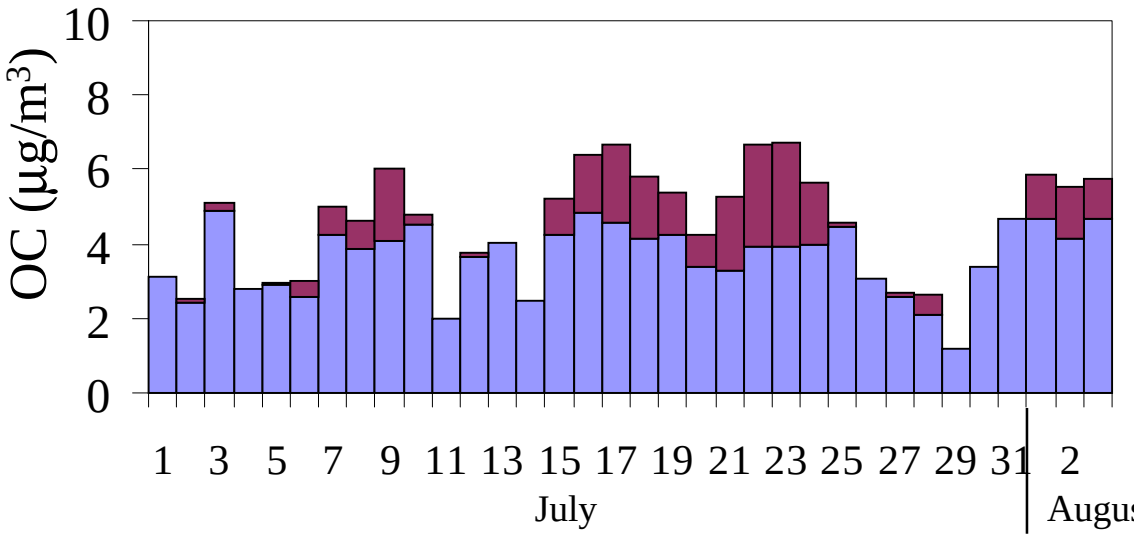


Undenuded Sampler
(24 hrs averages)

Denuded Sampler
(24 hrs samples)

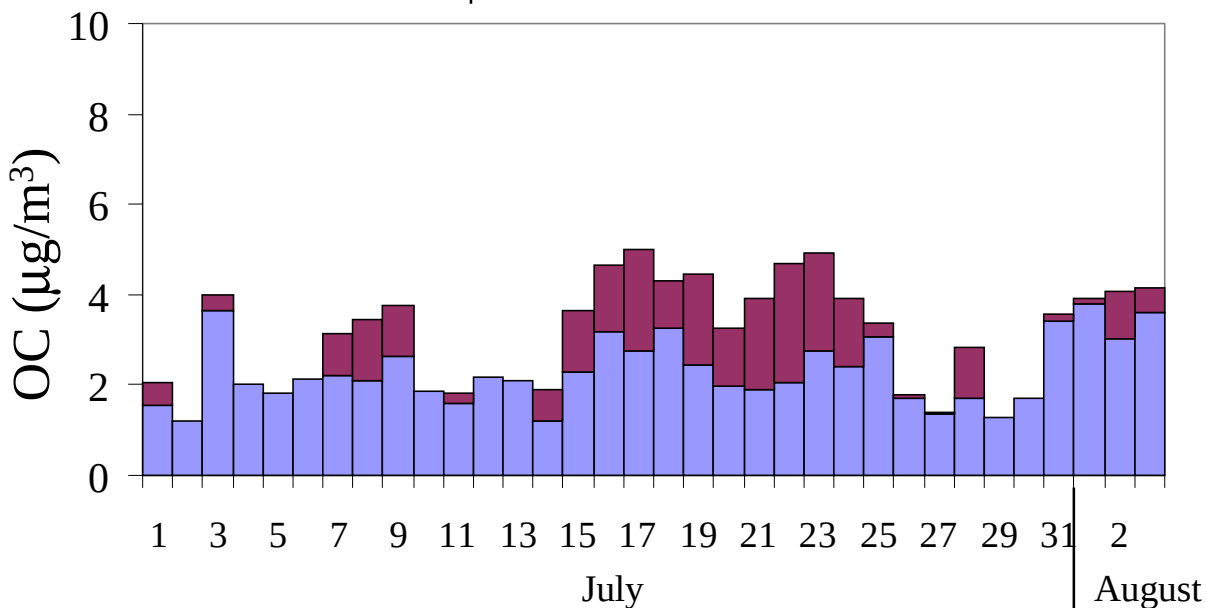


Daily OC Composition, July 2001

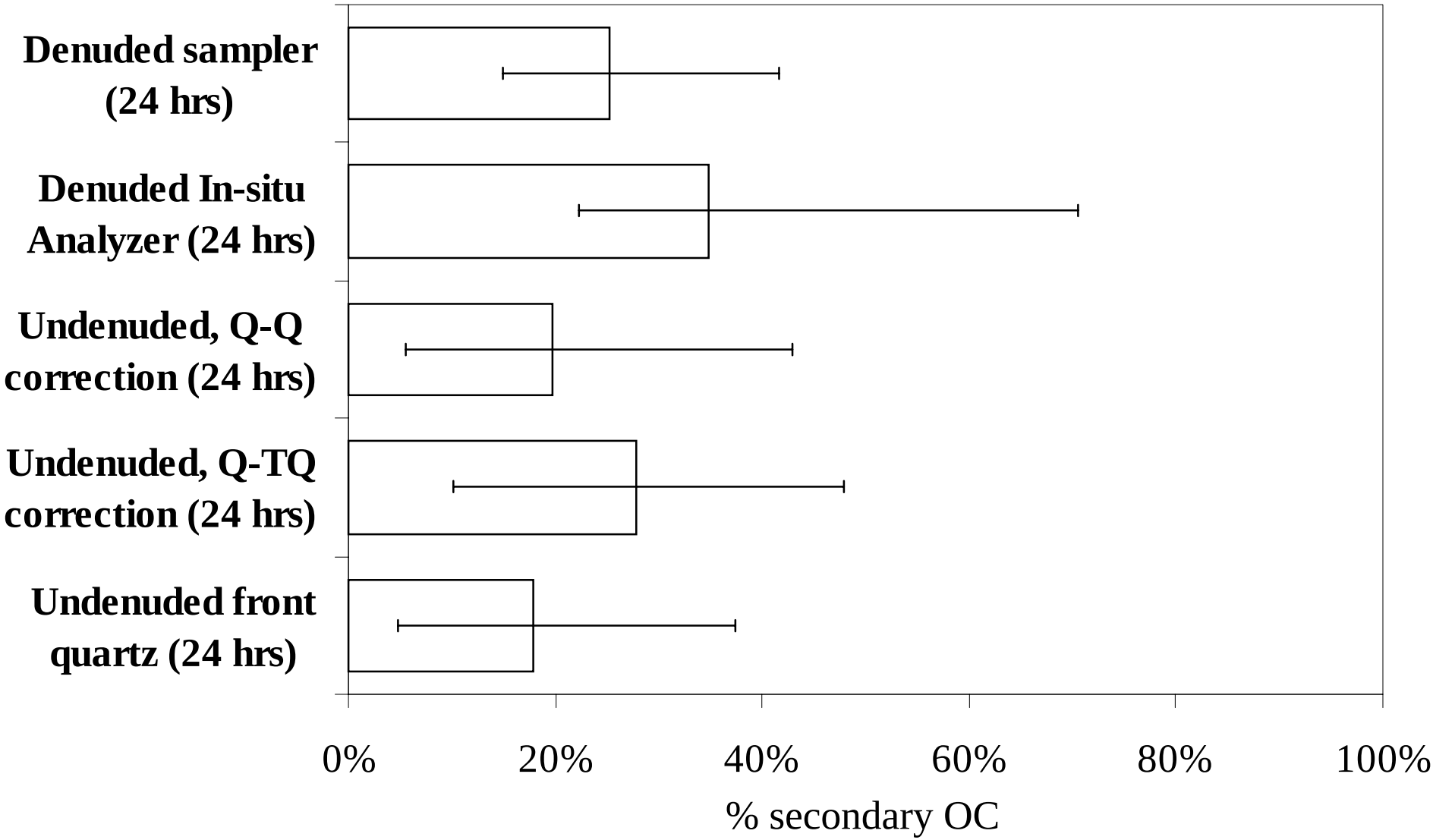


Undenuded Sampler
(24 hrs averages)

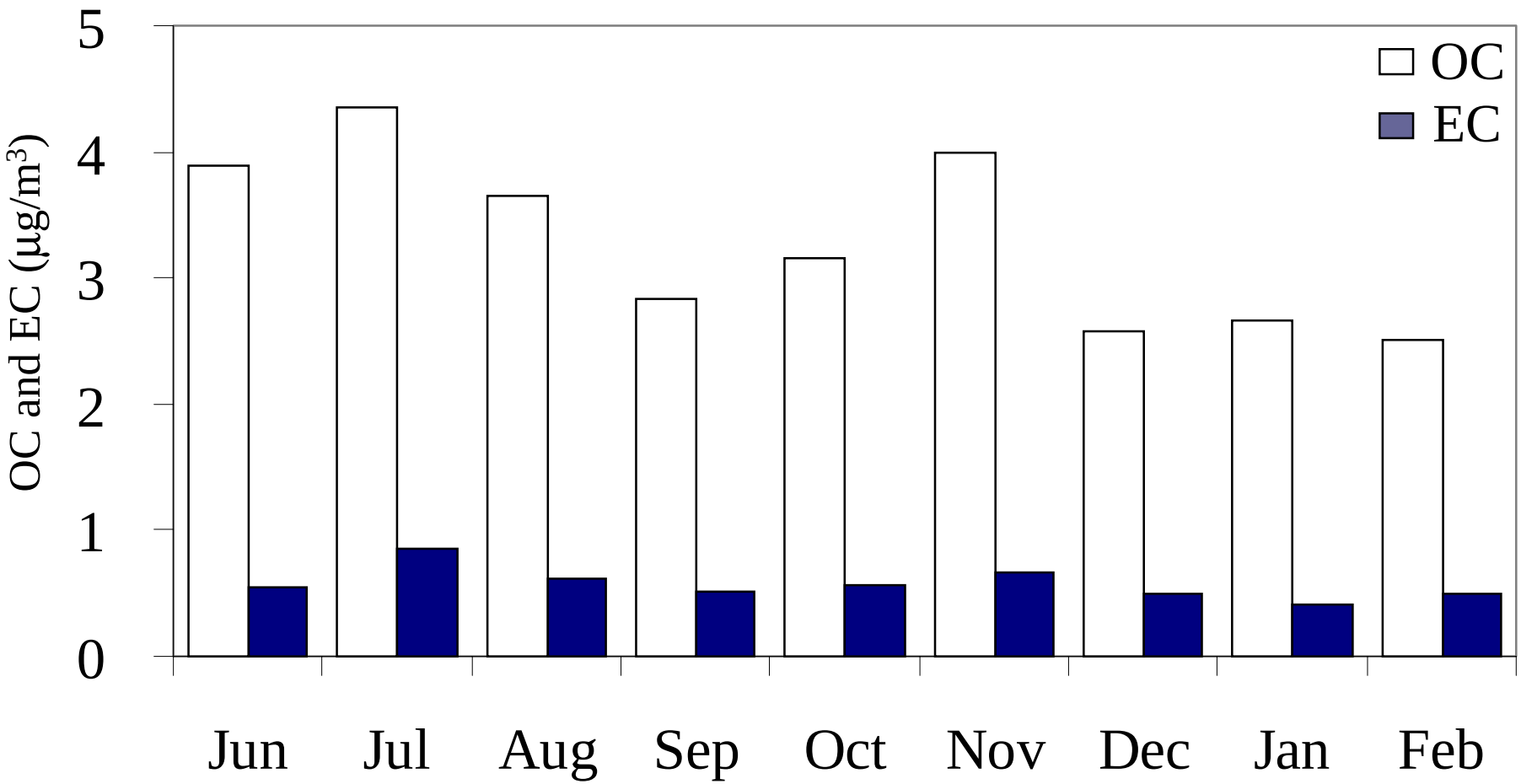
Denuded Sampler
(24 hrs samples)



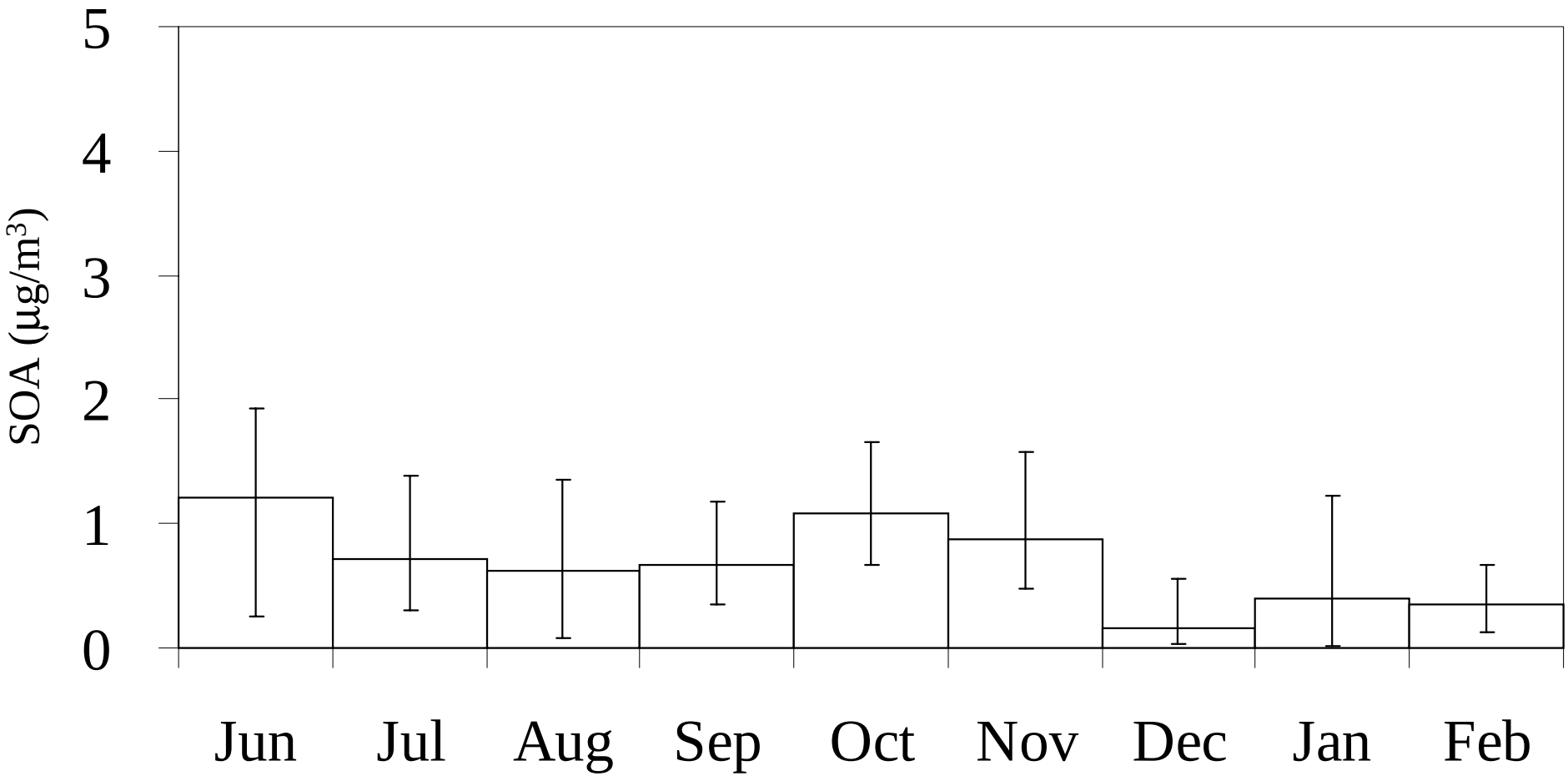
OC Composition, Daily Averages July



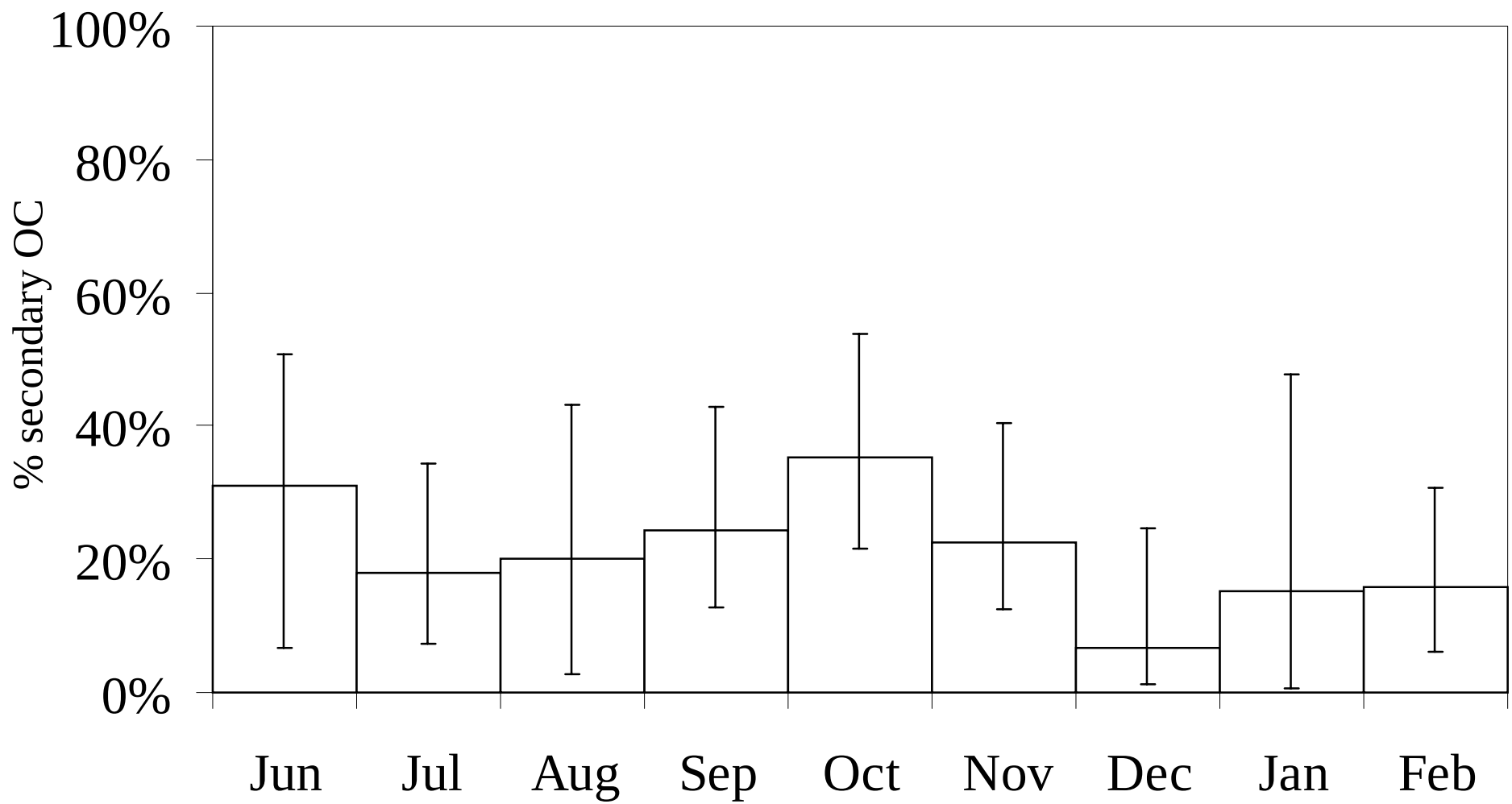
OC and EC measurements (front Quartz) Monthly Averages (2001-2002)



OC and EC measurements (front Quartz) Monthly Averages (2001-2002)



OC Composition (front Quartz), Monthly Averages (2001-2002)



Conclusions

- More than 80% of carbonaceous material in Pittsburgh is caused by long range transport.
- 20% to 50% of OC concentration could be secondary in origin.
- Different approaches for OC/EC ratio measurement give relatively consistent results.
- Higher sampling frequency gives higher estimates of SOA. (Ability to identify periods of primary and secondary OC)

Acknowledgements

- DOE/NETL and EPA Supersites Program for Supporting this work.